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June 14, 1996

Office of the Secretary
Federal Communications Commission
Room 222 -- Mail Stop 1170
1919 M Street NW
Washington, DC 20554

RE: Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters (ET Docket No. 96-8 RM-8608)

Dear Mr. Secretary,

Please find the enclosed original and four copies of the " COMMENTS OF GEC PLESSEY SEMICONDUCTORS TO NOTICE OF PROPOSED RULE MAKING" for filing with the commission in regards to the reference above.

If there are any questions or comments about this filing, please call me at (408) 439 6053 or e-mail at frank.della_corte@gpsemi.com. Thank you.

Respectively submitted,

Frank Della Corte

Enclosures

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

In the Matter of

Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters (ET Docket No. 96-8 RM-8608)

To: The Secretary

COMMENTS OF GEC PLESSEY SEMICONDUCTORS TO NOTICE OF PROPOSED RULE MAKING

1. Introduction

GEC Plessey Semiconductors (GPS) would like to address the FCC NPRM 96-8, and specifically the Petition for Rule Making RM-8608 by Symbol Technology Inc. (Symbol) regarding decreasing the number of channels, which was denied by FCC.

GPS would like to speak in general support of Symbol's petition and ask Commission to reconsider its position on this issue. GPS foresees the need for wider frequency channels in order to provide better service to the Wireless LAN users in the future. In addition, current 15.247 regulations favor DS systems relative to FH systems, and therefore widening the FH channels will provide better balance between the capabilities of the two types of systems. GPS joins the opinion that the coordination of the ISM band regulations with the European CEPT rulings will benefit US industry world-wide competitiveness. Therefore the Committee urges the Federal Communications Commission to accept an amended version of Symbol's petition, as presented below.

We address specific concerns of Commission as discussed in the NPRM. To our understanding, the main argument that caused denial of Symbol's petition was an assumption that Frequency Hopping system with wider channel width will cause more interference to current users of the band. To our technical opinion, the assumption of increased interference is incorrect, and we bring our analysis to show that usage of wider channels is not worse than with current regulations. In addition, we propose to amend Symbol's petition by a requirement saying "For a system occupying a total bandwidth of at least 75 MHz the number of hopping channels will be no less than 20" in order to resolve the concern about uneven use of the band. We recommend to increase the allowable FH bandwidth from

1 MHz to 4MHz to enable use of the previously described amendment. The wording we propose to replace the current text is as follows:

"(15.247.a.1.ii) Frequency hopping systems operating in the 2400-2483.5 MHz and 5275-5850 MHz bands shall use at least 75 hopping frequencies for systems utilizing up to 1 MHz wide channels. For a system occupying a total bandwidth of at least 75 MHz the number of hopping channels will be no less than 20. The maximum 20 dB bandwidth of the hopping channel is 4 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period or a (number of channels)*0.4sec period, whichever is smaller."

GPS' opinion is that the permission to use fewer but wider channels should be issued without transmit power penalty. The arguments for that are described below. Yet, if we need to prioritize issues, it is of higher priority to us to allow higher bandwidth than to maintain the full power level.

2. Unbalance between DS and FH systems in current regulation

When comparing DS and FH portions of the IEEE P802.11 standard it can be seen that although both types of systems achieve 1 and 2 Mbit/sec operation, the theoretical difference in sensitivity between the DS and FH system is around 8 dB. This difference results from the need, when operating with the chosen GFSK method at 1 Mbaud/sec, to reduce the frequency deviation to the extent that the resulting signal fits within the 1 MHz bandwidth.

The current regulation 15.247 of CFR 47 enables DS system to increase its baud rate up to 8.35 MHz (83.5 MHz divided by processing gain of 10). Although no company went to such extreme, the most popular DS wireless LANs (AT&T, Aironet etc.) operate at 1 Mbaud/sec, achieving 2 Mbit/sec operation, and there are systems with 2 Mbaud/sec (Windata) achieving 6 Mbit/sec. On the other hand, FH systems, with the 1 MHz channel bandwidth limitation cannot practically exceed the 1 Mbaud/sec operation. It is correctly stated in the NPRM that future FH systems may utilize quadrature modulation for increased efficiency. Even then, the baud rate of such system will be limited practically to about 700-800 kBaud/sec (e.g. quadrature modulation with rolloff factor of 0.3-0.4) and therefore will still be in disadvantage with respect to DS systems. In order to enable future FH systems to compete fairly with DS systems which can be practically constructed under current regulations (in the sense of using same baud rate and utilizing modulation methods with similar Eb/No requirements), FH channel bandwidth needs to be increased to about 2.5-3 MHz. When examining the multiple bit/Hz modulation as an alternative to increasing bandwidth it should be noted that not only the implementation cost increases but also the increased SNR requirements make the system more vulnerable to interference with which the FH system must coexist.

It may be argued that FH systems have an advantage of having larger number of simultaneously operated frequency channels. On the other hand, this advantage comes with the penalty of reduced instantaneous data rate. In many applications (such as software upload, file transfer, printing), systems are judged by the instantaneous bit rate and not by aggregate bit rate over the whole system. By allowing system designers to trade the number of simultaneously available channels for instantaneous bandwidth a better service to the customers can be provided.

We believe that inclusion of both DS and FH systems in 15.247 regulation meant providing for equal opportunity to both types of systems to compete in the market. In this respect, allowing wider channels for the hopping channels will improve the balance in capabilities of both types of systems.

3. Coexistence and mutual interference discussion

It will be shown below that for wideband FH hopping over same total bandwidth the interference either caused to or accepted from other systems (DS and narrowband FH) is not worse than today.

3.1 Coexistence of FH system with DS system

3.1.1 Interference caused by FH system to DS system

It was argued in replies stated in p. 18 of the NPRM that FH systems with wider bandwidth will interfere more with DS systems. This argument is incorrect, to our opinion. Let us look at the example of 1 Mbaud system with 13 dB of processing gain, i.e. 20 MHz bandwidth. When disturbing signal appears within its bandwidth the interference caused to the DS system is the total received power of the interferer reduced by the processing gain factor (in our example 13 dB), irrespective of its bandwidth, be it 1 MHz, 2 MHz or 4 MHz. The probability of collision between the FH interferer and the DS system is also determined mainly by the DS bandwidth. In the case of same example, FH system hopping over 80 MHz will interfere with 20 MHz DS system in 25% of its hops, irrespective of its bandwidth.

3.1.2 Susceptibility of FH system to interference caused by DS system

The degradation experienced by FH system due to presence of DS interferer depends solely on the power spectral density of the DS interferer versus the thermal noise spectral density. A wideband FH system will collect more interference power in its receive filter than a narrowband FH system, but it will also receive more thermal noise, so that the degradation factor will remain the same. The percentage of hops in which the FH system will receive interference

from the DS system depends mainly on the DS system bandwidth relative to the hopping bandwidth; for example, a 20 MHz wide DS transmitter will interfere with FH receiver hopping over 80MHz bandwidth in 25% of the hopping channels (disregarding the edge effect of partial overlap).

3.2 Coexistence of Wideband FH systems with Narrowband FH systems

3.2.1 Interference caused by Wideband FH system to Narrowband FH system

It was argued by Aironet, as stated in p 18 of the NPRM, that allowing wider FH channels will increase the interference to other FH systems. We would like to argue that opinion and show that interference between wideband and narrowband FH systems is in certain sense no worse than in the current situation. The degradation experienced by a narrowband FH system from another FH system being received at given power depends on the fraction of the power within the receiver bandwidth. For example a 1 MHz wide receiver, when receiving interference from a 4 MHz wide FH system, will receive only 1/4 of the interferers power. This is better than being interfered by 1 MHz wide system. On the other hand 1 MHz system will collide with 4 MHz system 4 times as often than with a 1 MHz system. The two factors (decrease in interference power and increase in percentage of collided channels) offset each other in the same manner as when examining interference caused by a DS system to a FH system. Assuming that FH systems can coexist with interference from DS systems, they can coexist also with wider FH systems.

3.2.1 Susceptibility of Wideband FH system to interference caused by a Narrowband FH system

When an FH system receives interference from the same or from a narrower FH system, degradation experienced by it depends on total received power. Therefore, as long as the regulatory power limit remains the same, the amount of interference received will not vary. The percentage of time in which collisions will occur will be dominated by the number of channels of the wider system.

4. Fairness in occupying the ISM band evenly

Some remarks to NPRM state that reducing the number of hop channels creates a possibility to abuse the ruling by implementing a 1 MHz bandwidth FH system with 20 channels and crowding all of them on one edge of the band. As discussed earlier, the coexistence properties of FH depend on total system bandwidth. For that reason we propose to allow smaller number of channels only to systems which occupy sufficiently large bandwidth. We propose to accept the Symbol's petition with the following amendments:

"(15.247.a.1.ii) Frequency hopping systems operating in the 2400-2483.5 MHz and 5275-5850 MHz bands shall use at least 75 hopping frequencies for systems utilizing up to 1 MHz wide channels. For a system occupying a total bandwidth of at least 75 MHz the number of hopping channels will be no less than 20. The maximum 20 dB bandwidth of the hopping channel is 4 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period or a (number of channels)*0.4 sec period, whichever is smaller."

5. Transmit power considerations

As indicated in the analysis above, the amount of interference produced by a FH system to DS systems is dominated by its power rather than bandwidth. Therefore we recommend to allow wider channels without requiring reduction of the transmitted power for wider band transmitters.

6. Why modify ISM regulations when other bands are being considered?

It was argued in NPRM that opening new frequency bands reduces the need to modify the ISM band ruling. We feel that providing a growth path within the ISM band is important in order to take advantage from the investment in technology for that band, for harmonization with the European CEPT rulings which apply to this band and improving worldwide competitiveness of the US industry.

7. Summary

GPS feels that in spite of the IEEE802.11 committee being just in the last stages of finalization of the first version of the standard there is a need to approach FCC with a request to modify its ruling so as to enable growth in performance in future WLAN equipments and markets. The IEEE802.11 Standard now in finalization would not be affected by the adoption of Symbol's petition, but flexibility for future growth in the Standard would be enabled. Therefore GPS speak strongly in support of Symbol's petition, with the amendments outlined above.

Respectfully submitted,

Jan 14, 1996

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